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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

At the University of Southampton, a National Conference on Quantum Electronics was held 14-16 September 1977. This is the third in a series of ~~such~~ conferences. The topics included laser theory, superfluorescence, laser applications to atomic and molecular physics, scattering and pollution monitoring, nonlinear optics, isotope separation and biomedical applications.

This report provides some general comments on the meeting as a whole

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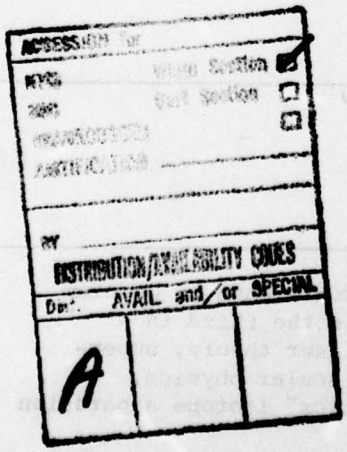
and summarises a few of the most interesting papers.



QUANTUM ELECTRONICS—A NATIONAL CONFERENCE AT SOUTHAMPTON

Introduction

The 3rd National Quantum Electronics Conference was held at the University of Southampton on 14-16 September 1977. It was sponsored by the Institute of Physics. The proceedings will not be published. Although this was a national conference, there was significant international participation, for among the 175 attendees there were representatives from 12 non-UK countries.

The topics included theoretical discussions of superfluorescence, mode locking and beam propagation; laser applications to atomic and molecular physics; laser isotope separation; specific laser developments; high power lasers and plasmas; nonlinear optics; laser scattering and propagation; and optoelectronic devices and materials. The breadth of coverage was nearly as large as that of the International Quantum Electronics Conferences.

Several papers treated relatively new topics, and therefore the meeting served the purpose of reviewing the state-of-the art in active laser research areas. One subject area not covered was holography, or optical signal processing, with the exception of one unscheduled paper.

I will discuss some of the topics under headings that are in some cases different from those in the Conference program. The reason for this is that a few papers were obviously placed in sessions without regard to subject matter in order to balance the number of papers in each session.

Lasers in Atomic and Molecular Physics

A subject of relatively recent concern, called superfluorescence (SF), was discussed in an invited paper by Professor R.K. Beullough [Department of Mathematics, Manchester University Institute of Science and Technology (U MIST) and in a contributed paper by Dr. Q.H.F. Vrehen (Philips Research Laboratories, Eindhoven, The Netherlands). Superfluorescence is a term used to describe the superradiant emission from a material in which all the energy levels forming an atomic molecular transition are initially completely inverted. Vrehen excited the 7P → 7S transition at 0.2391 μm in a pencil-shaped cell of atomic cesium vapor with a 2-nsec dye laser pulse. He obtained a short pulse (or pulses) emitted in a narrow cone along the axis, delayed in time from the excitation pulse and having a peak intensity proportional to the square of the atomic density. In addition, beats between hyperfine levels were observed. According to Beullough the theory of SF is incomplete. For example, the

beats in the output disagree with present theoretical calculations.

An excellent dissertation on the relatively new and interesting field of laser-excited Rydberg states was given by Dr. S. Haroche (Ecole Normale Supérieure, Paris) as part of an overall review of lasers in atomic spectroscopy. Rydberg states are highly excited states in which the principal quantum number, n, is very large—a few tens or more. As a result the excited electron is very far from the nucleus and sees the rest of the atom as a point charge.

Haroche discussed combined optical and microwave experiments that can be used to study transitions between these highly excited states. The initial level of a transition between Rydberg states can be excited by a tunable, visible (or uv), narrow-band laser, then the next higher state can be induced by microwave photons. Haroche pointed out the usefulness of these states for detecting microwaves for astrophysical or other applications. In this technique atoms in a beam are excited to a high-lying state, n, by a visible laser, and then raised to the n + 1 state by incoming microwave photons. A small electric pulse is applied with just the proper voltage to ionize the n + 1 state but not lower levels. This results in a potentially useful microwave detector in which one ion is produced per microwave photon.

Professor R.N. Dixon and D. Field (Univ. of Bristol, UK) authored a paper describing magnetic sub-level crossing experiments in NH_3. They claim to have obtained the first magnetic sub-level crossing spectra from a polyatomic system. These spectra are free of Doppler broadening, hence a resolution of one part in 10^8 was obtained. They measured the hyperfine splitting in the electronically excited state $\tilde{A}\ ^2A_1$ for a number of rotational levels in the (0,9,0) and (0,10,0) vibrational states. An interesting anomaly in the fluorescence excitation spectrum of an atomic sodium vapor near a glass surface was described by B. Bölger (Philips Research Laboratories, Eindhoven, The Netherlands). Bölger and his colleagues experimentally observed the fluorescence emitted into the glass above the critical angle for total internal reflection. The evanescent waves emitted from atoms within a distance of $\sim \lambda/2\pi$ were observed. The spectra exhibited a cut-off at a frequency above the resonant frequency (ν_o). This effect arises from the fact that atoms that have suffered collsions should be resonant at a frequency higher than ν_o, however, they have been deexcited by collisions and cannot adapt their polarization quickly enough to be reexcited in the short distance, $\lambda/2\pi$.

Isotope Separation

The subject of laser isotope separation was treated rather

lightly. No new results were presented; however, two good review papers were given by Dr. R. Denning (Oxford Univ.) and Dr. F. O'Neill (Rutherford Laboratory, Chilton, Didcot, Oxfordshire). Denning discussed various laser techniques that have been used for isolating ^{235}U in the past including multiphoton absorption of ir-laser radiation. He believes that the capital requirements for production of an annual tonne of 30% ^{235}U by laser will be less than that of conventional methods by a very large factor. Denning also foresees possible improvement in the efficiency of laser methods by the use of excimer lasers. O'Neill discussed various laser sources that have been developed or are under consideration for isotope separation of molecules. All the work he described has been carried out in the US.

Lasers (General)

C.B. Edwards (Blackett Laboratory, Imperial College, London) pointed out that rare-gas excimer lasers will be useful for practical applications, including isotope separation, only if electron-beam pumping at high repetition rates is used. These systems are unsuitable for discharge pumping because a large loss results from ionization of excited states of the molecules. Edwards described the construction and operation of a compact xenon excimer laser pumped by relativistic electrons. A peak power of 1 MW is achieved at a repetition rate of several pulses per second with an active volume of 10 cm^3. A coaxial electron-beam diode is used in which line emitters made of razor blades efficiently excite the gas volume.

The use of unstable resonators has improved the performance of certain laser systems, particularly CO_2 lasers. Two additional laser systems have also been improved by this method. First, Dr. G.C. Thomas (Dept. of Electronics, Univ. of Southampton) has obtained 1.0-mJ pulses in a diffraction-limited beam from a N_2 laser (3371-Å) oscillator-amplifier in which the oscillator has an unstable resonator with large magnification.

L.C. Laycock from the same Department described a joint project between the University of Southampton and J.K. Lasers Ltd., Rugby, Warwickshire, in which an unstable resonator has been used very successfully in a Nd-Yag laser at 1.06 μm. Energy output in the TEM_{oo} mode was an order of magnitude larger than available from the laser with a conventional stable resonator pumped with the same input energy. Near-diffraction-limited beam spreading was obtained. A laser output of 130 mJ was achieved with only 25-J input to the flashlamp at a pulse rate of 25 Hz.

Laser-Produced Plasmas

Several papers were given on laser-produced plasmas.

The study of x-rays emitted by these plasmas was the main topic of all the papers. Inversion of an x-ray transition at 182 Å was discussed in a paper by M.F. Lamb, C.L.S. Lewis, and J.A. Lunney (Queen's Univ. Belfast). They have used time-resolved spectroscopy to observe anomalous intensity ratios of Lyman-α to Lyman-β x-ray emissions in laser-produced C VI plasmas. This result indicates that a population inversion exists between the n=3 and n=2 levels. A few other experimenters have claimed inversion on this same transition recently. However, no one has yet produced a laser based on it. Lamb *et al* generate the plasma by depositing 25 GW of laser power on to a carbon foil with a line focus of 1 mm.

Nonlinear Optics

A new "bandwagon" has emerged within the last two years in laser research. It is best described under the general heading of nonlinear optics of free atoms and molecules in vapors and liquids. Dr. D.C. Hanna (Univ. of Southampton) reviewed this area of research. Some of the specific phenomena currently being investigated are: 3rd harmonic generation, stimulated hyper-Raman scattering (SHRS), stimulated electronic Raman scattering (SERS), and coherent anti-Stokes Raman scattering (CARS). W.H.W. Tuttlebee *et al* (University of Southampton) reported the first observation of tunable ir generation by SHRS in an atomic vapor. This effect is a fifth-order nonlinear process in which two incident pump photons are annihilated with the creation of a Stokes photon. They pumped Na vapor in a heat pipe oven with a rhodamine 6G dye laser and obtained a tunable, coherent beam at $\sim$ 2.3 μm as 2 ω_p (twice the pump frequency) was tuned near the 3S-4D two photon Na transition. A maximum conversion efficiency of 2% was achieved, being limited by ground state depletion.

Light Scattering and Pollution Monitoring

Dr. J.C. Earnshaw (Queen's Univ., Belfast) described his relatively new technique of observing laser scattering from thermally-excited capillary surface waves on liquids. He beats the scattered with the unscattered light and uses photon correlation spectroscopy to obtain the power spectrum and autocorrelation function from which surface tension and viscosity can be calculated.

Pollution monitoring using lasers was discussed in several papers. The technique receiving the most attention was differential absorption lidar (DIAL). This method consists of a measurement of backscattered, pulsed laser radiation which has been transmitted through the atmosphere at two wavelengths nearly simultaneously. One wavelength coincides with an absorption line for the pollutant gas being measured and the other with an atmospheric window. From these two return signals the concentration of pollutant

gas as a function of range can be obtained. This method is more sensitive than all the other lidar techniques for remote measurement of gases in the troposphere such as Raman scattering or fluorescence.

Biomedical Applications

Laser applications in biomedical studies are becoming more important. An example of this is a new experimental result reported by M. Anson (National Institute for Medical Research, Mill Hill, UK) in which he claims to have optically measured ear-drum vibrations for the first time in a live specimen. The technique employed is called laser speckle interferometry. This method doesn't require the attachment of mirrors as would be necessary in ordinary interferometry. The eardrum itself serves as a moving diffuse reflector. Diffuse reflected laser light is mixed with unscattered radiation to produce the interference. Motions smaller than 10 nm were measured. The specimen in this case was an American frog. Two peaks were observed in the frequency response curve at 200 and 1700 Hz.

Conclusions

This was a good general conference on lasers and laser applications. Most areas with the exception of holography and related topics as well as isotope separation were covered thoroughly with several excellent invited and contributed papers. Although no startlingly new results were presented, a few interesting new developments and laser applications were discussed, and the participants were brought up to date in most areas of a rapidly expanding subject.

APPENDIX I
CONFERENCE PROGRAM

WEDNESDAY 14 SEPTEMBER

SESSION 1: THEORY C
Chairman: Dr. E.R. Pike (RSRE, Malvern, Worcs., UK)

1 Invited paper on SUPERRADIANCE IN THE PURE SUPERFLUORESCENCE REGIME
R.K. Bullough [(Univ. Manchester Inst. of Science and Technology UMIST), Manchester, UK]

2 SUPERFLUORESCENCE IN ATOMIC CESIUM
Q.H.F. Vrehen (Philips Research Labs., Eindhoven, Netherlands) and H.M. Gibbs (Bell Labs., Murray Hill, N.J. USA)

3 DESIGN CRITERIA FOR PASSIVELY MODE-LOCKED GIANT PULSE LASERS
G.H.C. New (Imperial College, London, UK)

4 TRANSIENT EFFECTS IN THE PROCESS OF ACTIVE MODE-LOCKING OF LASERS
T.W. Chong and P.A. Lindsay (King's College, London University)

5 A VARIATIONAL METHOD FOR GAUSSIAN BEAM PROPAGATION
W.J. Firth (Heriot-Watt University Edinburgh, Scotland)

SESSION 2: LASERS IN ATOMIC AND MOLECULAR PHYSICS
Chairman: Professor R.N. Dixon (Bristol University Bristol, UK)

6 Invited paper on LASERS IN ATOMIC SPECTROCOPY
S. Haroche (Ecole Normale Supérieure, Paris, France)

7 DYE LASER DOPPLER-FREE SPECTROSCOPY OF HYPERFINE LEVELS IN ELECTRONICALLY EXCITED NH_2
R.N. Dixon and D. Field (Bristol University)

8 ANOMALY IN THE FLUORESCENCE EXCITATION SPECTRUM OF AN ATOMIC VAPOUR NEAR AN INTERFACE
A.L.J. Burgmans, B. Bölger and M.F.H. Schuurmans (Philips, Eindhoven, The Netherlands)

9 PHOTON CORRELATION MEASUREMENTS OF RESONANCE FLUORESCENCE EXCITED BY MONOCHROMATIC RADIATION
R.B. Dennis, H. Walther, K. Weyer, and K. Zygan (University of Munich, Munich, FRG)

10 LASER STARK SPECTROSCOPY OF THIOFORMALDEHYDE IN THE 10 μm REGION
D.J. Bedwell and G. Duxbury (Bristol University)

11 HETERODYNE TECHNIQUES IN HIGH RESOLUTION SPECTROSCOPY
J.A.R. Griffith, G.R. Isaak, R. New, M.P. Ralls,
C.P. van Zyl (Birmingham University, Birmingham, UK)

12 THE ABSORPTION SPECTRUM OF $^{127}I_2$ NEAR BALMER α AND
A SIMPLE METHOD OF IDENTIFYING ONE OF THE IODINE LINES
CHOSEN AS A WAVELENGTH REFERENCE MARKER
K.P. Birch and K.C. Shotton (National Physical Laboratory,
Teddington, Middlesex, UK)

SESSION 3: LASER ISOTOPE SEPARATION
Chairman: Professor S.D. Smith, FRS (Heriot-Watt University,
Edinburgh, Scotland)

13 Invited paper on LASER ISOTOPE SEPARATION TECHNIQUES
R.G. Denning (Oxford University, UK)

14 Invited paper on LASER SOURCES FOR ISOTOPE SEPARATION
F. O'Neill (Rutherford Laboratory, Chilton, Didcot, Oxon., UK)

15 A RATE EQUATION MODEL FOR AN OPTICALLY PUMPED MOLECULAR LASER
E. Armandillo and J.M. Green (Culham Laboratory, Abingdon,
Oxon, UK)

16 A LITHIUM NIOBATE PARAMETRIC OSCILLATOR SYSTEM
AS A VERSATILE INFRARED SOURCE
A.J.Turner, R. Wyatt, G. Tupper and R.C. Smith
(Southampton University, Southampton, UK)

17 A FREQUENCY DOUBLED CONTINUOUS WAVE DYE LASER
A. I. Ferguson and M.H. Dunn (St. Andrews University,
St. Andrews, Scotland)

SESSION 4: LASER I
Chairman: Professor D.J. Bradley, FRS (Imperial College)

18 REACTION MECHANISMS IN DISCHARGE-PUMPED KrF LASERS
M.J. Shaw (University College of Wales, Aberystwyth, Wales)

19 INTERNAL CAPACITOR DISCHARGE CONFIGURATIONS
A.J. Kearsley and C.E. Webb (Oxford University)

20 A REPETITIVE VACUUM ULTRAVOILET XENON LASER
C.B. Edwards, M.D. Hutchinson, and M.H.R. Hutchinson
(Imperial College)

21 COHERENT RADIATION FROM A NITROGEN LASER
G.C. Thomas, G.C. Chakrapani, and C.M.L. Kerr
(Southampton University)

22 COPPER I LASER EMISSION AT ROOM TEMPERATURE
A.J. Andrews, C.E. Webb, R.G. Denning, and R.C. Tobin
(Oxford University)

23 PARASITIC LOSS MECHANISMS IN HELIUM METAL VAPOUR LASERS
I,M. Littlewood, J.A. Piper, and C.E. Webb
(Oxford University)

24 AN UNSTABLE RESONATOR Nd:YAG LASER
D.C.Hanna, L.C. Laycock, (Southampton University)
and P.H. Sarkies and J.K. Wright (J.K. Lasers, Rugby, Warwicks, UK)

SESSION 5: POSTER SESSION

25 THE CALCULATION OF MULTIPOLE NONLINEAR OPTICAL SUSCEPTIBILITIES
M.A. Yuratich (Southampton University)

26 MEASUREMENTS OF SOME REACTION RATES OF RELEVANCE TO KrF LASERS
J.D.C. Jones and M.J. Shaw (University College of Wales, Aberystwyth)

27 OSCILLATION CHARACTERISTICS OF EXTERNAL CAVITY SYSTEMS AS USED WITH THE SPIN-FLIP RAMAN LASER
(B,S. Wherrett (Heriot-Watt University)

28 A LOW FIELD SPIN FLIP RAMAN LASER UTILISING A CLOSED CYCLE REFRIGERATOR
R.B. Dennis, W. Hinz, and H. Walther (University of Munich)

29 DESIGN OF PHOTOIONISATION TEA LASERS AND THE DISCHARGE MECHANISM
P.R. Browne and P.M. Webber (UMIST)

30 PHOTON CORRELATION VELOCIMETRY OF BLOOD FLOW IN THE RETINA
D.W. Hill, P. Parker, E.R. Pike and S. Young (RSRE, Malvern and Royal College of Surgeons)

31 FREQUENCY STABILISED LASERS, THEIR PROPERTIES AND APPLICATIONS
B.W. Jolliffe, W.R. Rowley, K.C. Shotton, A.J. Wallard, and P.T. Woods (National Physical Laboratory)

32 WHAT DOES SPONTANEOUS EMISSION LOOK LIKE?
L. Allen, S.P. Kravis, and J.S. Plaskett (Sussex University, Falmer, Brighton, UK)

33 AXIAL MODE STRUCTURE OF NITROGEN PUMPED DYE LASERS
A. Corney, K. Gardner, and J. McGinley (Oxford University)

34 POLARISATION SELECTION RULES FOR THE 3S-5S TRANSITION IN ATOMIC SODIUM VAPOUR
B.R. Marx and L. Allen (Sussex University)

35 NEGATIVE GLOW VERSUS POSITIVE COLUMN FOR HELIUM METAL-ION LASERS
P. Gill (National Physical Laboratory) and C.E. Webb (Oxford University)

THURSDAY 15 SEPTEMBER

SESSION 6: HIGH POWER LASERS AND PLASMAS I
Chairman: Dr. A.F. Gibson (Rutherford Laboratory)

36 Invited paper on HIGH POWER LASERS AND PLASMAS
M.J. Lubin (University of Rochester, Rochester, N.Y., USA)

37 SPACE-RESOLVED X-RAY SPECTRA FROM LASER PRODUCED PLASMAS
J.G. Lunney (Queen's University, Belfast) and M.H. Key (Rutherford Laboratory)

38 TIME RESOLVED SPECTROSCOPY OF SATELLITE LINES FROM LASER PPRODUCED PLASMA
L. Cooke, M.J. Lamb, C.L.S. Lewis, J.A. Lunney, A.K. Roy, and R.K. Thareja (Queen's University, Belfast)

39 CONVEX CRYSTAL SPECTROGRAPH DESIGN FOR OBSERVATIONS OF X-RAY SPECTRA AT THE CENTRAL LASER FACILITY
B.C. Fawcett and A. Ridgeley (Appleton Laboratory, Slough, Berks, and Culham Laboratory)

40 L-SERIES SPECTRA UP TO Z=42 FROM LASER-PRODUCED PLASMAS
L. Cooke, P. Hamilton, R.J. Hutcheon, S. Klemperer, C.L.S. Lewis, J.A. Lunney, and R.K. Thareja (Queen's University, Belfast)

41 POPULATION INVERSION OF THE Hα TRANSITION IN C VI AT 182 Å
M.J. Lamb, C.L.S. Lewis, and J.A. Lunney (Queen's University Belfast)

42 EXPERIMENTS ON PLASMA GENERATED BY PICOSECOND LASER PULSES
T.P. Donaldson, J.E. Balmer, P. Wagli, and J.A. Zimmerman (University of Berne, Berne, Switzerland)

SESSION 7: HIGH POWER LASERS AND PLASMAS II
Chairman: Professor S.A. Ramsden (Hull University, Hull, Yorks., UK)

43 Invited paper on LASER HEATING OF PLASMAS
I.J. Spalding (Culham Laboratory)

44 BEAM PROPAGATION THROUGH A HIGH POWER NEODYMIUM LASER SYSTEM
R.L. Hyde, C. Joshi, and K.O. Saarela (Hull University)

45 HIGH ENERGY CO_2 LASER BEAM QUALITY STUDIES
H.M. Lamberton, E.W. Parcell, and V.G. Roper (RSRE, BALDOCK, UK)

46 PERFORMANCE CHARACTERISTICS OF A KILOJOULE ELECTION-BEAM SUSTAINED CO_2 LASER
K.J. Andrews, P.E. Dyer, R.C. Knight, P. Monk, S.A. Ramsden, and B.L. Tait, (Hull University)

47 TRANSIENT SATURABLE ABSORBER FOR CO_2 LASERS
T. Stamatakis and A.C. Walker (Culham Laboratory)

48 OPERATING CHARACTERISTICS OF A SHORT PULSE IODINE LASER
H.J. Baker, D.R. Gray, T.A. King, W.G. McNaught, and E.S. Mukhtar (Manchester University)

49 RESONANT COHERENT INTERACTIONS ON SELECTED DEGENERATE TRANSITIONS
H.J. Baker, J.J. Bannister, D.R. Gray, and T.A. King (Manchester University)

SESSION 8: NONLINEAR OPTICS
Chairman: Dr. T.P. McLean (RSRE, Malvern)

50 Invited paper on NONLINEAR OPTICS OF FREE ATOMS AND MOLECULES
D.C. Hanna (Southampton University)

51 COHERENT ANTI-STOKES RAMAN SCATTERING IN CESIUM VAPOUR
A. Corney and K. Gardner (Oxford University)

52 TUNABLE INFRARED GENERATION BY STIMULATED HYPER-RAMAN SCATTERING
D. Cotter, D.C. Hanna, W.H.W. Tuttlebee, and M.A. Yuratich (Southampton University)

53 TWO-PHOTON RESONANT FOUR-WAVE PROCESSES AND TWO-PHOTON COHERENT STATES
P.R.C. Smith, J.N. Elgin, K.E. Orkney, and G.H.C. New (Imperial College)

54 HIGH-EFFICIENCY FREQUENCY DOUBLING OF 12.8 MICRON RADIATION IN Te
F. Al-Watban, R.G. Harrison, C.R. Pidgeon, and P. Maggs (Heriot-Watt University)

55 A CARS SPECTROMETER FOR THE STUDY OF HIGH TEMPERATURE INORGANIC SPECIES
I.R. Beattie, J.D.Black, T.R. Gilson, D.A. Greenhalgh, D.C. Hanna, and L.C. Laycock (Southampton University)

SESSION 9: LASER SCATTERING AND PROPAGATION
Chairman: Dr. T.A. King (Manchester University)

56 Invited paper on LASER SCATTERING AND PROPAGATION
P.N. Pusey (RSRE, Malvern)

57 CORRELATION FUNCTION DEPENDENCE OF SCINTILLATION BEHIND A RANDOM PHASE SCREEN
E. Jakeman and J.G. McWhirter (RSRE, Malvern)

58 LIGHT SCATTERING BY CYANOBIPHENYL LIQUID CRYSTALS
G.W. Bradberry (Exeter University) and J.M. Vaugham (RSRE, Malvern)

59 LASER AND ELECTRIC FIELD INDUCED EFFECTS IN MOLECULAR SYSTEMS
H.J. Coles and B.R. Jennings (Brunel University)

60 LASER INDUCED OPTICAL ACTIVITY
T. Thirunamachandram (University College, London)

61 SURFACE STUDIES OF LIQUIDS AND MONOLAYERS BY LASER BEAT SPECTROSCOPY
D. Byrne and J.C. Earnshaw (Queen's University, Belfast)

FRIDAY 16 SEPTEMBER

SESSION 10: OPTOELECTRONIC DEVICES AND MATERIALS
Chairman: Dr. M.H.Key (Rutherford Laboratory)

62 Invited paper on STREAK CAMERAS AND THEIR APPLICATIONS
W. Sibbett (Imperial College)

63 BEHAVIOUR OF PHOTOCATHODES WHEN OPERATING IN THE PICOSECOND REGION
S. Majumdar (Royal Holloway College, Egham Hill, Surrey, UK)

64 PICOSECOND PULSE GENERATION IN A SYNCHRONOUSLY MODE-LOCKED CW DYE LASER
D.J. Bradley, L.S. Goldberg, J.P. Ryan, and W. Sibbett (Imperial College)

65 OPTICAL RECTIFICATION IN N-TYPE GALIUM PHOSPHIDE
P.J. Gatenby, A.F. Gibson , C.B. Hatch, A.K. Kar, and M.F. Kimmitt (Essex University, Colchester, Essex, UK)

66 ACOUSTO-OPTIC BRAGG MODULATOR FOR CO_2 LASERS
B.S. Collins and K.F. Hulme (RSRE, Malvern)

67 HETERODYNE PERFORMANCE OF GERMANIUM ACOUSTO-OPTIC MODULATORS
D.V. Willetts and W.R.M. Pomeroy (RSRE,Malvern)

SESSION 11: LASER APPLICATIONS
Chairman: Professor R.S. Smith (Southampton University)

68 Invited paper on LASER TECHNIQUES FOR POLLUTION MONITORING
E.L. Thomas (Hull University)

69 DIFFERENTIAL ABSORPTION LIDAR
R.S. Adrian, D.J. Brassington, S. Sutton and R.H. Varey
[Central Electricity Generating Board (CEGB), Marchwood, Southampton and Leatherhead, Surrey, UK]

70 M MEASUREMENT OF THE DIFFERENTIAL ABSORPTION CONFFICIENT OF NO_2 AND SO_2 FOR APPLICATION IN THE REMOTE SENSING OF POLLUTANTS USING DIAL TECHNIQUES
B.W. Jolliffe and P.T. Woods (National Physical Laboratory)

71 LONG RANGE LASER VELOCIMETRY
R. Foord, J. O'Shaughnessy, W.R.M. Pomeroy, and J.M. Vaughan (RSRE, Malvern)

72 PRESSURE STRUTURE OF LASER INDUCED WATER SHOCKS
G.P. Davidson, D.C. Emmony, L.A. Mahmood, and T.P. Maloney (Loughborough University, Loughborough, Leicester, UK)

73 LASER EXCITATION OF FLUORESCENCE IN BIOMOLECULES
M. Anson and P.M. Bayley (Nat. Inst. for Medical Research, Mill Hill, London, UK)

SESSION 12: LASERS II
Chairman: Dr. I.J. Spalding (Culham Laboratory)

74 Invited paper on OPTICALLY PUMPED FAR INFRARED LASERS
C.R. Pidgeon and R.G. Harrison (Heriot-Watt University)

75 STUDIES OF SOME OPTICALLY PUMPED MILLIMETRE WAVEGUIDE LASERS
G. Duxbury and H. Herman (Bristol University)

76 SELF DEFOCUSING AND OTHER DESIGN CONSIDERATIONS IN A HIGH POWER FAR INFRARED LASER SYSTEM
M. Siegrist, M.R. Green, and P.D. Morgan (Ecole Polytechnique, Lausanne, Switzerland)

77 SEMICONDUCTOR ELECTRODES FOR GAS LASERS
A.F. Gibson, T.A. Hall, A.B. Hatch, M.F. Kimmitt, and K.R. Rickwood (Essex University, Colchester, UK)

78 NUMERICAL MODELLING OF A CHEMICAL PLASMA
S.A. Roberts (Leeds University, Leeds, Yorks., UK)

79 FREQUENCY STABILISED CO_2 WAVEGUIDE LASER
D.R. Hall, R.M. Jenkins, and E.K. Gorton (RSRE, Baldock)

80 A SEALED UV-PREIONISATION TEA LASER WITH HIGH PEAK POWER OUTPUT
D.S. Stark, P.H. Cross, and M.R. Harris (RSRE, Baldock)

81 A COMPACT, TUNABLE, HIGH PRESSURE CO_2 LASER
K.J. Andrews, T. Carman, and P.E. Dyer (Hull University)

82 THE INFLUENCE OF ADDITIVES ON TEA CO_2 LASER PERFORMANCE
R. Bhatnagar, P.E. Dyer, and G. Salvetti (Hull University)

SESSION 13: POSTDEADLINE SESSION
Chairman: Dr. C.E. Webb (Oxford University)